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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/840,629	04/23/2001	Jason W. Trobaugh	13297.00019	3963

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EXAMINER	
EDWARDS, PATRICK L	

ART UNIT	PAPER NUMBER
2624	

DATE MAILED: 07/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/840,629	TROBAUGH ET AL.	
	Examiner	Art Unit	
	Patrick L. Edwards	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21,23-33,35-42 and 44-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *5-10,13-15,18-21,24-30,32,33,36-42,44,46,47,49 and 50* is/are allowed.

6)☒ Claim(s) *1-4,11,12,16, 17, 23, 31, 35, 45, 48, 51-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04-27-2006 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4, 12, 16-17, 23, 31, 35, 48, 51, 52, and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by Sheehan et al. (USPN 6,106,466).

Respecting claim 1—which is representative of claim 23—Sheehan discloses developing acoustic properties for a medium based on a variation of a point-scatterer representation of the medium microstructure (col. 14 lines 41-49: The reference describes determining acoustic properties of the medium (all properties determined by ultrasound are acoustic properties because ultrasound is dealing with sound). The reference does not use the word "point-scatterer," but this is inherent in the disclosure. Ultrasound works because points of the object to be imaged reflect sound. This is explained in a printout that is provided—not to teach a limitation—but merely to show that this limitation is inherent in the Sheehan refernece.).

Sheehan further discloses developing gross shape based on the variation of the medium microstructure (col. 14 in conjunction with Fig. 11: Sheehan discloses developing archetype shape (i.e. gross shape).).

Sheehan discloses developing imaging system characteristics (see Fig. 11: Reference numeral 212 referring to a physics model of ultrasound reflection and attenuation in and and around the heart (i..e. imaging system characteristics).).

Sheehan further discloses incorporating the imaging system characteristics, the gross shape, and the variation of the medium microstructure to form the image model (see col. 14 in conjunction with Fig. 11: As can be seen in the figure, 210, 212, and 216 are incorporated to form the ultrasound imaging model).

Respecting claims 2 and 31, Sheehan further discloses that the image model includes a data likelihood enabling a statistical inference to formulate underlying characteristics (see column 14, lines 22-26: The reference describes that the image model is based on a knowledge base of ventricular shapes defined by rotations, translations, and scaling of the set of training data (i.e. data likelihood) with the estimated covariance matrix for each of the vertices of the archetype shape (i.e. enabling a statistical inference).).

Sheehan further discloses that the data likelihood is constructed as a product of density functions characterizing each pixel (see col. 14 lines 22-26: the reference discloses a covariance matrix which is a product of density functions because it is defined with pixel values which are functions of the density of light at a give spot. The reference describes that the covariance gives the expected deviation from all the given pixel locations (i.e. product of density functions.)).

Sheehan further discloses that the density function characterizing each pixel is assigned to each pixel based upon a classification of each pixel determined by a ratio of an amplitude mean value and a standard deviation value (Sheehan col. 14 lines 57-63: As was touched on in the above rejection to claim 1, Sheehan discloses that the pixels are characterized based upon a mean image and an expected deviation (i.e. standard deviation).).

Regarding claims 3, Sheehan discloses that the gross shape is described by a triangulated surface and acoustic properties of the triangulated surface are represented by multiple discrete scattereres distributed across the triangulated surface in a random model (see col. 12 in conjunction with Figure 8).

Regarding claim 16, Sheehan et al. disclose that the gross shape is described by a triangulated surface (see Fig. 8: As can be seen in the figure, the archetype model (i.e. gross shape) is described by a triangulated surface.).

Regarding claim 17, Sheehan et al. disclose that the triangulated surface includes a set of triangular elements defined by respective vertices and edges of the triangular elements (see Fig. 8: As can be seen in the figure, the triangulated surface includes a set of triangular elements defined by respective vertices and edges of the triangular elements.).

As applied to claim 12, Sheehan et al. disclose that tissue is characterized by a reflectivity function (see column 10, lines 8-15: The reference describes that the epicardial surface of the heart (i.e. tissue) can be characterized by the reflected intensity of a sound wave (i.e. reflectivity function) as provided for in equation (5).).

With regard to claim 51, Sheehan further discloses that the gross shape is described by a volume of space (sheehan col. 1 line 66 – col. 2 line 2, and elsewhere throughout the specification).

With regard to claim 52, Sheehan fails to explicitly recite that the acoustic properties of the volume of space are represented by multiple discrete scatterers distributed across the volume. However, this limitation is inherent in the Sheehan disclosure as it is well established in the field of ultrasonic imaging that any object to be imaged is comprised of discrete targets which are distributed across the volume of the object. These discrete cell targets, which are found in tissue, for example, are commonly referred to as "scatterers."

With regard to claim 54, Sheehan discloses estimating the shape of an object (sheehan col. 14 line 39).

Regarding claims 35 and 48, Sheehan further discloses a computer readable medium for performing the method (see generally, Sheehan).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sheehan et al. (U.S. Patent No. 6,106,466 A) and Seyed-Bolorforosh (U.S. Patent No. 5,841,889 A). The arguments as to the relevance of Sheehan et al. in the rejection of claim 1 above are incorporated herein.

Claim 11 calls for the imaging system characteristics to be described by a point spread function.

This element is absent from Sheehan et al.; however, Seyed-Bolorforosh, in the same field of endeavor of image processing and the same problem solving area of ultrasound imaging discloses such a feature (see column 3, lines 46-50: The reference describes the use of a three-dimensional point spread function.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Sheehan et al. by describing the imaging system characteristics using a three-dimensional point spread function as taught in Seyed-Bolorforosh because the use of such a three-dimensional point spread function gives the system the "ability to distinguish between different tissue types in a clinical ultrasound image" (see Seyed-Bolorforosh: column 3, lines 59-60).

6. Claims 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sheehan et al. (U.S. Patent No. 6,106,466 A) and Seyed-Bolorforosh (U.S. Patent No. 5,841,889 A). The arguments as to the relevance of Sheehan et al. in the rejection of claim 1 above are incorporated herein.

Sheehan fails to expressly disclose that spatial locations of scatterers across a triangulated surface are parametrized by a scatterer concentration and a surface roughness. Seyed discloses that the spatial locations of scatterers are parametrized by a scatterer concentration and a surface roughness (seyed col. 4 lines 34-58). It would have been obvious to one reasonably skilled in the art at the time of the invention to modify Sheehan's image model forming method by parametrizing surfaces using scatterer concentration and surface roughness as taught by Seyed. Such a modification would have allowed for a way of collecting additional information about the surface of the model that would have made for a more accurate representation.

7. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sheehan et al. (USPN 6,106,466) and Seyed-Bolorforosh (USPN 5,841,889) (herein 'Seyed').

With regard to claim 1, Sheehan et al. disclose a method for forming an image model, comprising the steps of: a. developing imaging system characteristics (see Sheehan Fig. 11: Reference numeral 212 referring to a physics model of ultrasound reflection and attenuation in and around heart (i.e. imaging system characteristics).); b. developing gross shape (see Sheehan Fig. 11: Reference numeral 210 referring archetype shape (i.e. gross shape).); c. developing microstructure (see Sheehan Fig. 11: Reference numeral 216 referring to structural model of cardiac anatomy (i.e. microstructure).); d. incorporating the imaging system characteristics, the gross shape and the microstructure to form the image model (see Sheehan Fig. 11: As can be seen in the figure, 210, 212, and 216 are incorporated to form the ultrasound imaging model.).

Further referring to claim 1, the above paragraph aptly states that Sheehan teaches the limitation of developing microstructure. The amended claim, however, requires developing sub-wavelength microstructure. This limitation is not expressly disclosed in Sheehan. Seyed, also in the field of ultrasound image processing, discloses developing sub-wavelength microstructure (Seyed col. 3 lines 45-50: The reference discloses developing microsture (i.e. the texture of the tissue, which determines the type of tissue) which is small compared to wavelength (i.e. sub-wavelength). The 'reflectors' disclosed in the cited passage is simply referring to the tissue that the sound waves are reflecting off of (see col. 4 lines 15-16).).

It would have been obvious to one reasonably skilled in the art at the time of the invention to determine Sheehan's smoothness parameters (sheehan col. 14 line 45) as a sub-wavelength microstructure as taught by Seyed. Such a modification would have allowed for the ability to distinguish between different tissue types This would have been a very desirable result, because "The ability to distinguish between tissue types in a clinical ultrasound image is very important for the detection of diseased tissue" (see Seyed col. 3 lines 59-61).

8. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sheehan as applied to claim 1 above, and further in view of Slayton et al. (USPN 6050943). The arguments as to the relevance of the aforesaid combination as applied above are incorporated herein.

Claim 53 adds the feature of an image model being used to estimate the the temperature of an object. Sheehan is silent with respect to temperature estimations. Slayton, however, discloses an ultrasonic transducer system that provides imaging capabilities and temperature estimation capabilities (see Slayton abstract). It would have been obvious to one reasonably skilled in the art at the time of the invention to augment Sheehan's method for image modeling by adding temperature estimation capabilities as taught by Slayton. Such a modification would have allowed for a more robust system capable of developing image models of objects and also estimating the temperature of those objects.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick L. Edwards whose telephone number is (571) 272-7390. The examiner can normally be reached on 8:30am - 5:00pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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